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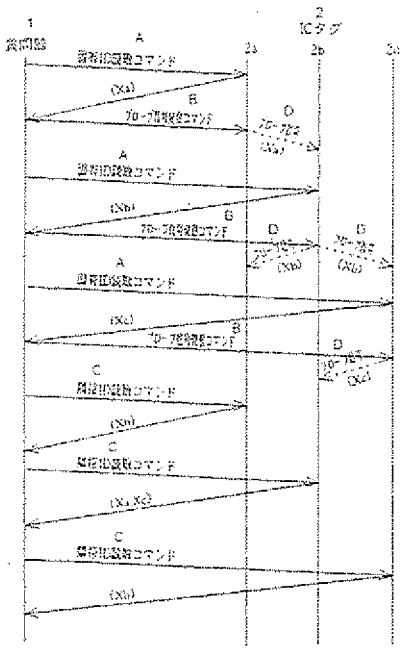
(81) 指定国 (表示のない限り、全ての種類の国内保護が可能): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) 指定国 (表示のない限り、全ての種類の広域保護が可能): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), ユーラシア (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), ヨーロッパ (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[続葉有]

(54) Title: IC TAG LOCATION RECOGNITION DEVICE AND METHOD

(54) 発明の名称: ＩＣタグのロケーション認識装置および方法



1 QUESTION DEVICE
2 IC TAG
A UNIQUE ID READ COMMAND
B PROBE SIGNAL TRANSMISSION COMMAND
C ADJACENT ID READ COMMAND
D PROBE SIGNAL

(57) Abstract: A question device (1) reads unique ID Xa, Xb, Xc, specifies ID, and transmits a probe signal transmission command. The corresponding IC tags successively transmit a probe signal. An adjacent IC tag (2) stores the ID specified by the question device Xa, Xb, Xc as adjacent ID in a memory. Next, the question device (1) reads the adjacent ID. A controller obtains combinations of unique ID Xa, Xb, Xc with the adjacent ID (Xb), (Xa-Xc), (Xb) as (Xa - Xb), (Xb - Xc). Lastly, they are connected into (Xa - Xb - Xc).

[続葉有]

WO 2005/069499 A1

From the INTERNATIONAL BUREAU

PCT

SECOND AND SUPPLEMENTARY NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION (TO DESIGNATED OFFICES WHICH APPLY THE 30 MONTH TIME LIMIT UNDER ARTICLE 22(1))

(PCT Rule 47.1(c))

To:

MAKI, Tetsuro
Suite 402, Shuwa Kioicho Park Bldg.
3-6, Kioi-cho, Chiyoda-ku, Tokyo
1020094
JAPON

Date of mailing *(day/month/year)*	
18 May 2006 (18.05.2006)	
Applicant's or agent's file reference: LSI-P2	**IMPORTANT NOTICE**
International application No.: PCT/JP2005/000620	International filing date *(day/month/year)*: 13 January 2005 (13.01.2005)
Priority date *(day/month/year)*: 13 January 2004 (13.01.2004)	
Applicant: LSI JAPAN CO., LTD. et al	

1. **ATTENTION**: For any designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002 (30 months from the priority date), **does not apply**, please see Form PCT/IB/308(First Notice) issued previously.

2. Notice is hereby given that the following designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002, **does apply**, has/have requested that the communication of the international application, as provided for in Article 20, be effected under Rule 93*bis*.1. The International Bureau has effected that communication on the date indicated below:
28 July 2005 (28.07.2005)

   AU, AZ, BY, CN, CO, DZ, EP, HU, KG, KP, KR, MD, MK, MZ, NA, PG, RU, SY, TM, US

   In accordance with Rule 47.1(c-*bis*)(i), those Offices will accept the present notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

3. The following designated Offices, for which the time limit under Article 22(1), as in force from 1 April 2002, **does apply**, have not requested, as at the time of mailing of the present notice, that the communication of the international application be effected under Rule 93*bis*.1 :

   AE, AG, AL, AM, AP, AT, BA, BB, BG, BR, BW, BZ, CA, CR, CU, CZ, DE, DK, DM, EA, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, ID, IL, IN, IS, JP, KE, KZ, LC, LK, LR, LS, LT, LV, MA, MG, MN, MW, MX, NI, NO, NZ, OA, OM, PH, PL, PT, RO, SC, SD, SG, SK, SL, SM, TJ, TN, TR, TT, UA, UZ, VC, VN, YU, ZA, ZW

   In accordance with Rule 47.1(c-*bis*)(ii), those Offices accept the present notice as conclusive evidence that the Contracting State for which that Office acts as a designated Office does not require the furnishing, under Article 22, by the applicant of a copy of the international application.

4. **TIME LIMITS for entry into the national phase**

   For the designated or elected Office(s) listed above, the applicable time limit for entering the national phase will, **subject to what is said in the following paragraph,** be **30 MONTHS** from the priority date.

   In practice, **time limits other than the 30-month time limit** will continue to apply, for various periods of time, in respect of certain of the designated or elected Office(s) listed above. For **regular updates on the applicable time limits** (30 or 31 months, or other time limit), Office by Office, refer to the *PCT Gazette*, the *PCT Newsletter* and the *PCT Applicant's Guide*, Volume II, National Chapters, all available from WIPO's Internet site, at http://www.wipo.int/pct/en/index.html.

   It is the applicant's **sole responsibility** to monitor all these time limits.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.+41 22 740 14 35

Authorized officer
Yoshiko Kuwahara

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2005/000620

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] H04B1/59, H04B5/02, G01S13/74

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] H04B1/59, H04B5/02, G01S313/74

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Toroku Jitsuyo Shinan Koho 1994-2005
Kokai Jitsuyo Shinan Koho 1971-2005 Jitsuyo Shinan Toroku Koho 1996-2005

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2003-158470 A (Lucent Technologies Inc.), 30 May, 2003 (30.05.03), Par. No. [0040] & US 5952922 A1 & EP 851239 A1 & CA 2219074 A1	1-7
A	WO 2002/103645 A2 (RF CODE, INC.), 27 December, 2002 (27.12.02), Abstract & US 2003-30568 A1 & EP 1410353 A & JP 2005-500516 A & CA 2450727 A	1-7

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 March, 2005 (18.03.05)	05 April, 2005 (05.04.05)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer

国際調査報告

国際出願番号　PCT／JP2005／000620

A.　発明の属する分野の分類（国際特許分類（IPC））
Int. Cl⁷　　H04B1／59　H04B5／02　G01S13／74

B.　調査を行った分野

調査を行った最小限資料（国際特許分類（IPC））
Int. Cl⁷　　H04B1／59　H04B5／02　G01S13／74

最小限資料以外の資料で調査を行った分野に含まれるもの
日本国実用新案公報　1922－1996年
日本国公開実用新案公報　1971－2005年
日本国登録実用新案公報　1994－2005年
日本国実用新案登録公報　1996－2005年

国際調査で使用した電子データベース（データベースの名称、調査に使用した用語）

C.　関連すると認められる文献

引用文献のカテゴリー＊	引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示	関連する請求の範囲の番号
A	JP　2003－158470　A（ルーセント　テクノロジーズ　インコーポレーテッド），　2003．05．30， 段落番号【0040】 &US　5952922　A1 &EP　851239　A1 &CA　2219074　A	1-7

☒ C欄の続きにも文献が列挙されている。　☐ パテントファミリーに関する別紙を参照。

＊　引用文献のカテゴリー
「A」特に関連のある文献ではなく、一般的技術水準を示すもの
「E」国際出願日前の出願または特許であるが、国際出願日以後に公表されたもの
「L」優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献（理由を付す）
「O」口頭による開示、使用、展示等に言及する文献
「P」国際出願日前で、かつ優先権の主張の基礎となる出願の日の後に公表された文献
「T」国際出願日又は優先日後に公表された文献であって出願と矛盾するものではなく、発明の原理又は理論の理解のために引用するもの
「X」特に関連のある文献であって、当該文献のみで発明の新規性又は進歩性がないと考えられるもの
「Y」特に関連のある文献であって、当該文献と他の1以上の文献との、当業者にとって自明である組合せによって進歩性がないと考えられるもの
「&」同一パテントファミリー文献

国際調査を完了した日	国際調査報告の発送日
18．03．2005	05.4.2005

国際調査機関の名称及びあて先	特許庁審査官（権限のある職員）		
日本国特許庁（ISA／JP） 郵便番号100－8915 東京都千代田区霞が関三丁目4番3号	江口　能弘	5W	8125
	電話番号　03－3581－1101　内線　6511		

C（続き）．　関連すると認められる文献

引用文献のカテゴリー＊	引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示	関連する請求の範囲の番号
A	WO　2002／103645　A2（RF　CODE，INC） 2002．12．27，要約欄 &US　2003－30568　A1 &EP　1410353　A &JP　2005－500516　A &CA　2450727　A	1-7

AMENDMENT (According to JP Relevant Law Section 11)

(filed on 21 June 2005)

Mr. Commissioner of the Patent Office

1 Identification of the International Application

PCT/JP2005/000620

2 Applicant

Name: LSI JAPAN Co., Ltd.

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151-0051 Japan

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3 Agent(s)

Name: (7777) Patent Attorney MAKI, Teturo

Address: Suite 402, Shuwa Kioicho Park Bldg.
3-6, Kioi-cho, Chiyoda-ku, Tokyo, 102-0094, JAPAN

4 Item(s) to be Amended

Description and Claims

5 Contents of Amendment

(1) Lines 14 to 20 on page 2 are amended as follows:

"a first response means for responding own information X according to a first readout command from [~~to~~] the interrogator,

a transmission means for sending out said probe signals to the other IC tags according to a send out command from the interrogator,

a reception means for receiving said probe signals sent out by the other IC tags,

a storage means for storing information Y of a source IC tag contained in the send out command in a memory when reception strength of said probe signal is more than a predetermined level, and

a second response means for responding information Y of the source IC tag stored in the memory to the interrogator according to a second readout command,"

(2) Line 22 on page 16 is amended as "and information Y of the source IC tag (adjacency information) stored in the memory"

(3) Claims 1, 5, 6, and 7are amended as in the attached new Claims.

6 List of Attached Documents

(1) Substitute page 2 and 2/1 — one copy each (2 pages)

(2) Substitute page 16 — one copy

(3) Substitute pages 17 and 18 (new claims) — one copy each

Summary of the Invention:

In order to solve the problems that mutual interference would occur and disturb communication when a plurality of interrogators are allocated at respective inventory locations, and that misreading would be caused as radio wave would reach adjacent inventory locations when IDs of items are read per designated antenna, the present invention is aimed at providing means for automatically locating IC tags affixed on items without having to have to allocate an interrogator or an antenna at each and every inventory location.

To attain this object, the main claim of the present invention comprises a system for location recognition using IC tags, wherein an interrogator makes a first communication with multiple IC tags existing in a communication area A by radio, and at the same time, said IC tag makes a second communication with other IC tags existing in a communication area B (<A) by probe signals, said IC tag comprising;

a first response means for responding own information X according to a first readout command from the interrogator,

a transmission means for sending out said probe signals to the other IC tags according to a send out command from the interrogator,

a reception means for receiving said probe signals sent out by the other IC tags,

a storage means for storing information Y of a source IC tag contained in the send out command in a memory when reception strength of said probe signal is more than a predetermined level, and

a second response means for responding information Y of the source IC tag stored in the memory to the interrogator according to a second readout command,

whereby relative positions of said IC tags are recognized from the information X and the information Y collected via said interrogator.

Brief Description of the Drawings:

Fig.1 is a schematic view of the location recognition system using IC tags according to the present invention.

Fig.2 is a block diagram of the IC tag according to the present invention.

Fig.3 shows how a reception voltage E changes in proportion with distance d.

Fig.4 is a sequence chart of protocols communicating between interrogator 1 and IC tags 2 according to the present invention.

Fig.5 is a process flow chart of interrogator 1.

Fig.6 is a process flow chart of IC tag 2.

Fig.7 is a schematic view of the first preferred embodiment of the present invention.

Fig.8 is a sequence flow between interrogator 1 and IC tags 2 according to the first embodiment.

IC tag 2 with ID 6 only responds to this command and simultaneously sends back ID 7 stored in the memory.

Interrogator 1 now reads out ID 7 as adjacent ID of ID 6, then specifies ID 7 and transmits the adjacent ID readout command.

IC tag 2 with ID 7 only responds to this command and simultaneously sends back ID 6 stored in the memory.

Interrogator 1 now reads out ID 6 as adjacent ID of ID 7 and all reading out is ended.

Lastly, all possible combinations (1-5), (2-3), (3-2), (5-1), (6-7), (7-6) of unique IDs (1, 2, 3, 5, 6, 7) and adjacent IDs (5, 3, 2, 1, 7, 6) that controller 3 has collected via interrogator 1 are obtained, and identical combinations are excluded so as that (1-5), (2-3), (6-7) remain as final combinations.

In this case, these combinations are considered as link patters of ID information, since none of the final combinations has one side in common.

Thus, it is understood that IC tags 2 with IDs (1, 5), (2, 3), and (6, 7) exist in separate communication areas B1, B2, and B3 respectively, and that IC tags 2 with IDs 3, 1, 6, which correspond to pieces of a board game, are positioned in contact with IC tags 2 with IDs 2, 5, 7, which correspond to placing positions on a board.

Industrial Applicability:

In the location recognition system using IC tags according to the present invention, the IC tags communicate each other using probe signals in communication area B (<A), whose range is less than that of communication area A of the interrogator and the IC tags. When a probe signal with reception strength over a predetermined level is received, the receiving IC tag stores information Y of the source IC tag in the memory, and sends back its own information X and information Y of the source IC tag (adjacency information) stored in the memory to the interrogator, so that the relative position of the IC tags could be recognized from information X and information Y collected via the interrogator.

Therefore, the IC tags in communication area A can be divided into groups according to their relative positions, and locations of the IC tags can be specified by making these groups and the IC tags arbitrary correspond.

Accordingly, it will be possible that items in inventory locations and inventory locations of items can both be recognized by using only one interrogator or antenna, without requiring interrogators or antennas be allocated at respective inventory locations.

Moreover, it is not necessary to deliberately shield the inventory locations from each other in order to prevent misreading caused by radio wave leakage.

CLAIMS

1. (Amended) A system for location recognition using IC tags, wherein an interrogator makes a first communication with multiple IC tags existing in a communication area A by radio, and at the same time, said IC tag makes a second communication with other IC tags existing in a communication area B (<A) by probe signals, said IC tag comprising;

a first response means for responding own information X according to a first readout command from the interrogator,

a transmission means for sending out said probe signals to the other IC tags according to a send out command from the interrogator,

a reception means for receiving said probe signals sent out by the other IC tags,

a storage means for storing information Y of a source IC tag contained in the send out command in a memory when reception strength of said probe signal is more than a predetermined level, and,

a second response means for responding the information Y of the source IC tag stored in the memory to the interrogator according to a second readout command,

whereby relative positions of said IC tags are recognized from the information X and the information Y collected via said interrogator.

2. (As originally filed) The system for location recognition using IC tags as described in claim 1, wherein all possible combinations of said information X and information Y are obtained, and any of said combinations having one side of information in common are joined so that locations and arrangement order of said IC tags are specified.

3. (As originally filed) The system for location recognition using IC tags as described in claim 1, wherein either one of radio wave, magnetism, sound, and light, which are all omnidirectional propagation media that become attenuated progressively with distance, is used for said probe signals.

4. (As originally filed) The system for location recognition using IC tags as described in claim 1, wherein communication range of said communication area B is adjusted at different lengths depending on sizes and arrangement of items to which said IC tags are affixed.

5. (Amended) The system for location recognition using IC tags as described in claim 1, wherein responses of said first response means and second response means are made while the interrogator specifies response requirements so as to avoid collisions.

6. (Amended) The system for location recognition using IC tags as described in claim 1, wherein said probe signals are transmitted while the interrogator specifies response requirements so as to avoid collisions.

7. (Amended) A method for location recognition using IC tags, wherein an interrogator makes a first communication with multiple IC tags existing in a communication area A by radio, and at the same time, said IC tag makes a second communication with other IC tags existing in a communication area B (<A) by probe signals, said IC tag comprising;

a first response step in which said IC tag responds own information X according to a first readout command from the interrogator,

a transmission step in which said IC tag sends out said probe signals to the other IC tags according to a send out command from the interrogator,

a reception step in which said IC tag receives said probe signals sent out by other IC tags,

a storage step in which said IC tag stores information Y of a source IC tag contained in the send out command in a memory when reception strength of said probe signal is more than a predetermined level, and

a second response step in which said IC tag responds information Y of the source IC tag stored in the memory to the interrogator according to a second readout command,

whereby relative positions of said IC tags are recognized from the information X and the information Y collected via said interrogator.

AMENDMENT (According to JP Relevant Law Section 11)

(filed on 16 March 2006)

Mr. Commissioner of the Patent Office

1 Identification of the International Application

PCT/JP2005/000620

2 Applicant

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Nationality: JAPAN

Residence: JAPAN

3 Agent(s)

Name: (7777) Patent Attorney MAKI, Teturo

Address: Suite 402, Shuwa Kioicho Park Bldg.
3-6, Kioi-cho, Chiyoda-ku, Tokyo, 102-0094, JAPAN

4 Item(s) to be Amended

Description and Claims

5 Contents of Amendment

(1) Lines 14 to 21 on page 2 are amended as follows:

"a first response means for responding own information X [~~according to a first readout command from~~] to the interrogator,

a transmission means for sending out said probe signals to the other IC tags when own information X is specified by the interrogator, [~~according to a send-out command from the interrogator,~~]

a reception means for receiving said probe signal[~~s~~] sent out by one of the other IC tags whose information Y is specified by the interrogator,

a storage means for storing information Y of the other IC tag specified as a source by the interrogator [~~a source IC tag contained in the send-out command~~] in a memory when reception strength of said probe signal is more than a predetermined level, and"

(2) Lines 9 and 10 on page 5 are amended as "receiving side receives is inversely proportional to distance d(m) between IC tags 2 on both sending and receiving sides."

(3) "sequentially" at line 19 on page 5 is deleted.

(4) "sequentially" at line 22 on page 5 is deleted.

(5) "sequentially" at line 27 on page 5 is deleted.

(6) "In other word, their locations are recognized." is added at line 35 on page 5.

(7) Claims 1, 5, 6, and 7 are amended as in the attached new Claims.

6 List of Attached Documents

(1) Substitute page 2 and 2/1 one copy each (2 pages)

(2) Substitute page 16 one copy

(3) Substitute pages 17 and 18 (new claims) one copy each

Summary of the Invention:

In order to solve the problems that mutual interference would occur and disturb communication when a plurality of interrogators are allocated at respective inventory locations, and that misreading would be caused as radio wave would reach adjacent inventory locations when IDs of items are read per designated antenna, the present invention is aimed at providing means for automatically locating IC tags affixed on items without having to have to allocate an interrogator or an antenna at each and every inventory location.

To attain this object, the main claim of the present invention comprises a system for location recognition using IC tags, wherein an interrogator makes a first communication with multiple IC tags existing in a communication area A by radio, and at the same time, said IC tag makes a second communication with other IC tags existing in a communication area B (<A) by probe signals, said IC tag comprising;

a first response means for responding own information X to the interrogator,

a transmission means for sending out said probe signals to the other IC tags when own information X is specified by the interrogator,

a reception means for receiving said probe signal sent out by one of the other IC tags whose information Y is specified by the interrogator,

a storage means for storing information Y of the other IC tag specified as a source by the interrogator in a memory when reception strength of said probe signal is more than a predetermined level, and

a second response means for responding information Y of the source IC tag stored in the memory to the interrogator according to a second readout command,

whereby relative positions of said IC tags are recognized from the information X and the information Y collected via said interrogator.

Brief Description of the Drawings:

Fig.1 is a schematic view of the location recognition system using IC tags according to the present invention.

Fig.2 is a block diagram of the IC tag according to the present invention.

Fig.3 shows how a reception voltage E changes in proportion with distance d.

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Fig.5 is a process flow chart of interrogator 1.

Fig.6 is a process flow chart of IC tag 2.

Fig.7 is a schematic view of the first preferred embodiment of the present invention.

Fig.8 is a sequence flow between interrogator 1 and IC tags 2 according to the first embodiment.

Therefore, the storing/retrieving of ID is performed only when one IC tag 2 makes a single response as a result of the anti-collision protocols.

Whether there is a singular response or plural responses can be detected by checking a bit pattern of a received signal using a cyclic check code (CRC) etc, since a disorder arises in the bit pattern when plural responses overlap: when an error is detected in the bit pattern, it is judged that there are plural responses.

In a free space, as shown in Fig. 3, when transmission power Pt (W) of the probe signal sent out by IC tag 2 on a sending side is constant, reception voltage E (V/m) that IC tag 2 on a receiving side receives is inversely proportional to distance d(m) between IC tags 2 on both sending and receiving sides.

Consequently, as distance d between IC tags 2 on both sending and receiving sides becomes shorter (as d1>d2>d3), reception voltage E received by IC tag 2 on the receiving side rises higher (as E1<E2<E3).

Therefore, the distance between IC tags 2 on both sending and receiving sides can be detected from the level of reception voltage E that IC tag 2 on the receiving side receives.

A sequence chart of protocols communicating between interrogator 1 and IC tags 2 according to one embodiment of the present invention is shown in Fig. 4.

Firstly, interrogator 1 transmits the unique ID readout command specifying read range, and corresponding IC tags 2a, 2b, 2c reply their respective unique IDs (Xa), (Xb), (Xc).

At the same time, interrogator 1 transmits the probe signal send out command specifying ID, and corresponding IC tags 2a, 2b, 2c send out probe signals respectively.

At this time, IC tag 2 that has detected the probe signal whose reception strength is over a predetermined level stores IDs (Xa), (Xb), (Xc) specified by interrogator 1 in its memory as adjacent IDs.

Then, interrogator 1 transmits the adjacent ID readout command specifying ID, and corresponding IC tags 2a, 2b, 2c reply adjacent IDs (Xb), (Xa.Xc), (Xb) stored in their respective memories.

Lastly, all possible combinations (Xa-Xb), (Xb-Xa), (Xb-Xc), (Xc-Xb) of unique IDs (Xa), (Xb), (Xc) and adjacent IDs (Xb), (Xa.Xc), (Xb) that controller 3 has collected via interrogator 1 are obtained, and any identical combinations are excluded so that the final combinations (Xa-Xb), (Xb-Xc) remain. Then, any of the final combinations having one side in common are joined so that a link pattern of ID information (Xa-Xb-Xc) is produced.

Thus, it is understood that IC tags 2a, 2b, 2c exist in the same communication area B, and are arranged in order of 2a, 2b, 2c. In other word, their locations are recognized.

CLAIMS

1. (Amended) A system for location recognition using IC tags, wherein an interrogator makes a first communication with multiple IC tags existing in a communication area A by radio, and at the same time, said IC tag makes a second communication with other IC tags existing in a communication area B (<A) by probe signals, said IC tag comprising;

a first response means for responding own information X to the interrogator,

a transmission means for sending out said probe signals to the other IC tags when own information X is specified by the interrogator,

a reception means for receiving said probe signal sent out by one of the other IC tags whose information Y is specified by the interrogator,

a storage means for storing information Y of the other IC tag specified as a source by the interrogator in a memory when reception strength of said probe signal is more than a predetermined level, and,

a second response means for responding the information Y of the source IC tag stored in the memory to the interrogator according to a second readout command,

whereby relative positions of said IC tags are recognized from the information X and the information Y collected via said interrogator.

2. (As originally filed) The system for location recognition using IC tags as described in claim 1, wherein all possible combinations of said information X and information Y are obtained, and any of said combinations having one side of information in common are joined so that locations and arrangement order of said IC tags are specified.

3. (As originally filed) The system for location recognition using IC tags as described in claim 1, wherein either one of radio wave, magnetism, sound, and light, which are all omnidirectional propagation media that become attenuated progressively with distance, is used for said probe signals.

4. (As originally filed) The system for location recognition using IC tags as described in claim 1, wherein communication range of said communication area B is adjusted at different lengths depending on sizes and arrangement of items to which said IC tags are affixed.

5. (Amended) The system for location recognition using IC tags as described in claim 1, wherein responses of said first response means and second response means are made to all the IC tags existing in said communication area A while the interrogator specifies response requirements so as to avoid collisions.

6. (Amended) The system for location recognition using IC tags as described in claim 1, wherein said probe signals are transmitted to all the IC tags existing in said communication

area A while the interrogator specifies response requirements so as to avoid collisions.

7. (Amended) A method for location recognition using IC tags, wherein an interrogator makes a first communication with multiple IC tags existing in a communication area A by radio, and at the same time, said IC tag makes a second communication with other IC tags existing in a communication area B (<A) by probe signals, said IC tag comprising;

a first response step in which said IC tag responds own information X to the interrogator,

a transmission step in which said IC tag sends out said probe signals to the other IC tags when own information X is specified by the interrogator,

a reception step in which said IC tag receives said probe signal sent out by one of the other IC tags whose information Y is specified by the interrogator,

a storage step in which said IC tag stores information Y of the other IC tag specified as a source by the interrogator in a memory when reception strength of said probe signal is more than a predetermined level, and

a second response step in which said IC tag responds information Y of the source IC tag stored in the memory to the interrogator according to a second readout command,

whereby relative positions of said IC tags are recognized from the information X and the information Y collected via said interrogator.